CLAIMS

Claims 1 – 16 (canceled).

Claim 17 (original): A method for controlling aircraft lift, the aircraft having at least one wing, the method comprising:

mounting an oscillating aero surface to the aircraft wing;

connecting a resonant frame to the oscillating aero surface;

mounting an actuator to the resonant frame; and

producing a sinusoidal force on the resonant frame resulting in a resonant deformation in the resonant frame and resonant-sinusoidal displacement of the aero-surface.

Claim 18 (original): The method of claim 17 wherein the actuator is a linear voice coil actuator.

Claim 19 (original): The method of claim 17 and further comprising:

applying transverse to the motion of the aero-surface such that the sinusoidal force developed by the actuator on the resonant frame results in a resonant rocking motion of the resonant frame, resonant deformation of the columns, and resonant-sinusoidal displacement of the aero-surface.

Claim 20 (original): The method of claim 17 and further comprising:

mounting the aero surface flush with an upper surface of the aircraft when the actuator is unpowered.

Claim 21 (original): The method of claim 20 and further comprising:

transmitting acoustic frequency alternating current through the voice coil device; and

producing a force, the force varying sinusoidally in time.

Claim 22 (original): The method of claim 21 and further comprising:

matching the frequency of the voice coil alternating current with the elastic resonance frequency of the resonant frame and oscillating aero-surface mass-spring system

thereby resulting in amplitude oscillatory motion of the aero-surface perpendicular to the aircraft wing surface.

Claim 23 (original): The method of claim 22 and further comprising:

projecting the top portion of the oscillating aero-surface cyclically into the air flowing over the top surface of the wing; and

disturbing the smooth flow over the wing causing local flow separation and vortex structures.

Claim 24 (original): The method of claim 23 and further comprising:

reducing the vacuum pressure at local points on the wing; and

changing the coefficient of lift which can be used to maneuver the aircraft or to suppress aerodynamic flutter.

Claim 25 (original): The method of claim 20 and further comprising:

returning the oscillating aero-surface to a position flush with the upper wing surface upon depowering.

Claim 26 (original): The method of claim 17 and further comprising:

providing two or more systems within the aircraft wing.

Claim 27 (original): The method of claim 26 and further comprising:

operating each system independently of the other systems with specific displacement, phase relationship, and operation frequency of the second device is selected to amplify the lift modification effects of the first device.

Claim 28 (original): The method of claim 27 and further comprising:

originating a wave-like flow disturbance structure at a first device;

increasing the disturbance as subsequent effectors cause flow disturbance resonance and the attenuation of the lift effects follows a similar spatial-time pattern with the

cyclic displacement of each of the aero-effector devices being actively canceled resulting in a return to smooth flow over the wing.

Claim 29 (new): A method for controlling the pressure, velocity, boundary layer structure, separation, or vortex structure across a flow surface, the method comprising:

mounting an oscillating aero surface to the flow surface;

connecting an elastic frame to the oscillating aero surface;

mounting an actuator to the elastic frame; and

producing a periodic force on the elastic frame resulting in motion of the aero surface selected from the group consisting of under-resonant, near resonant, resonant, and super-resonant.

Claim 30 (new): The method of claim 29 and further comprising:

dynamically changing the pressure at local points on the flow surface;

changing the instantaneous lift coefficient; and

changing the moment coefficients.

Claim 31 (new): The method of claim 29 and further comprising:

projecting a top portion of the oscillating aero surface cyclically into the air flowing over the flow surface; and

disturbing the smooth flow over the flow surface causing local flow separation and vortex structures.

Claim 32 (new): The method of claim 29 wherein the aero surface is selected from the group consisting of a fence, a bump, a depression, a forward facing step, a backward facing step, a spoiler, a cavity, sudden projection away from the surface into the flow, and sudden depression into the flow surface away from the flow.

Claim 33 (new): The method of claim 29 and further comprising:

mounting the aero surface flush with the flow surface when the actuator is unpowered.

Claim 34 (new): The method of claim 29 and further comprising:

returning the oscillating aero-surface to a position flush with the flow surface upon depowering.

Claim 35 (new): The method of claim 29 and further comprising:

modulating the periodic displacement of the aero surface with periodic displacement amplitude modulation waveforms selected from the group consisting of triangular, haversine (half sine wave), and square wave, random, an any combination, with or without the use of partial duty cycle.

Claim 36 (new): The method of claim 29 and further comprising:

active intensification of flow disturbances whereby a transient flow disturbance is created by a first device; and

increasing intensity by the operation of one or more subsequent devices under open-loop or closed loop control.

Claim 37 (new): The method of claim 29 and further comprising:

actively attenuating flow disturbances whereby a transient flow disturbance created by the operation of a first device is decreased in intensity by the operation of one or more subsequent devices under open-loop or closed loop control.

Claim 38 (new): The method of claims 37 and further comprising:

operating a cooperative system composed of two or more devices with specific position, displacement amplitude, phase relationship, duty cycle, and operation frequency of at least one of the devices selected to amplify favorable lift modification effects or the pressure, velocity, boundary layer structure, separation, or vortex structure across a flow surface.

Claim 39 (new): The method of claim 29 wherein the actuator operates in a linear or a rotary fashion under forces selected from the group consisting of electrical, magnetic, electro-magnetic, pneumatic, hydraulic, piezoelectric, magnetostrictive, and thermally-induced structural and

producing a force or moment on an elastic structure or frame or aero surface from the linear operation or the rotational operation of the actuator.

Claim 40 (new): The method of claim 29 and further comprising:

applying a linear force or a mechanical moment on any elastic aero-surface suspension selected from the group consisting of:

a structure that includes or is composed of one or more gas filled or vacuum filled elastic chambers,

a structure that includes or is composed of one or more extensional springs selected from the group consisting of helical springs and elastomeric springs based on a rubber like substance or an elastic shell structure,

a structure that includes one or more elastic torsional elements,

a structure that includes one or more elastic flexural elements.

Claim 41 (new): The method of claim 40 and further comprising:

applying a periodic linear force or mechanical moment on the frame such that the force developed by the actuator on the elastic structure resulting in a periodic displacement in the structure, and an under-resonant, near resonant, resonant, or super-resonant periodic motion of the aero-surface.

Claim 42 (new): The method of claim 41 wherein the range of displacement motion of the aero-surface are controlled by changes in the actuator drive level or changes in the elastic structure's stiffness or changes in the mass distribution across the structure.

Claim 43 (new): The method of claim 41 wherein the frequency of oscillation is alterable by changes in part or the whole of the elastic structure's stiffness or changes in the mass distribution across the structure.

Claim 44 (new): The method of claim 29 wherein the aero surface is selected from the group consisting of a fence, a bump, a depression, a forward facing step, a rearward facing step, a

spoiler, and a cavity mounted on the surface driven from the group consisting of an electrically operated voice-coil actuator, a linear servo-electric motor, and a rotary electric motor.

Claim 45 (new): The method of claim 44 and further comprising:

mounting the aero surface flush with the flow surface when the actuator is unpowered.

Claim 46 (new): The method of claim 44 and further comprising:

returning the oscillating aero-surface to a position flush with the flow surface upon depowering.

Claim 47 (new): The method of claim 44 and further comprising:

applying a time periodic force transverse to the motion of the aero-surface such that the periodic force developed by the actuator on the resonant frame results in a resonant flexural rocking motion of the resonant frame, deformation of the columns, and under-resonant, near resonant, resonant or super-resonant periodic motion of the aero-surface.

Claim 48 (new): The method of claim 44 and further comprising:

modulating the periodic displacement of the aero surface with periodic displacement amplitude modulation waveforms selected from the group consisting of triangular, haversine (half sine wave), square wave, random, and any combination with or without the use of partial duty cycle so the primary frequency of the amplitude modulation matches the primary frequency of the flutter of the surface, and that the phase of the amplitude modulation is selected to be effective in the reduction of the forces driving the flutter of the flow surface.

Claim 49 (new): The method of claim 44 and further comprising:

changing the electrical drive to the actuator under closed loop control with input from a flow sensor.

Claim 50 (new): The method of claim 44 and further comprising:

providing two or more electrically driven aero surface systems within the flow surface separated either spanwise or chordwise or some combination of spanwise and chordwise separation.

Claim 51 (new): The method of claim 50 and further comprising:

actively intensifying flow disturbances whereby a transient flow disturbance is created by a first device and increased in intensity by the operation of one or more subsequent devices under open-loop or closed loop control.

Claim 52 (new): The method of claim 50 and further comprising:

actively attenuating flow disturbances whereby a transient flow disturbance created by the prior or present operation of a first device is decreased in intensity by the operation of one or more subsequent devices under open-loop or closed loop control.

Claim 53 (new): The method of claim 51 and further comprising:

operating a cooperative system composed of two or more devices with specific position, displacement amplitude, phase relationship, duty cycle, and operation frequency of any or all devices selected to amplify favorable lift modification effects for maneuvering, improved performance, or to suppress flutter, or modifying the pressure, velocity, boundary layer structure, separation, or vortex structure across a flow surface.

Claim 54 (new): The method of claim 51 and further comprising:

actively attenuating lift effects whereby the cyclic displacement of each of the aero-effector devices are operated so that a return to smooth flow over the wing is achieved in near minimum or minimum time, the forward and subsequent aero surface systems being operated under open-loop control, or closed loop control with input from one or more flow sensors, the operation of all devices selected to amplify favorable lift modification effects for maneuvering, improved

performance, or to suppress flutter, or modifying the pressure, velocity, boundary layer structure, separation, or vortex structure across a flow surface.